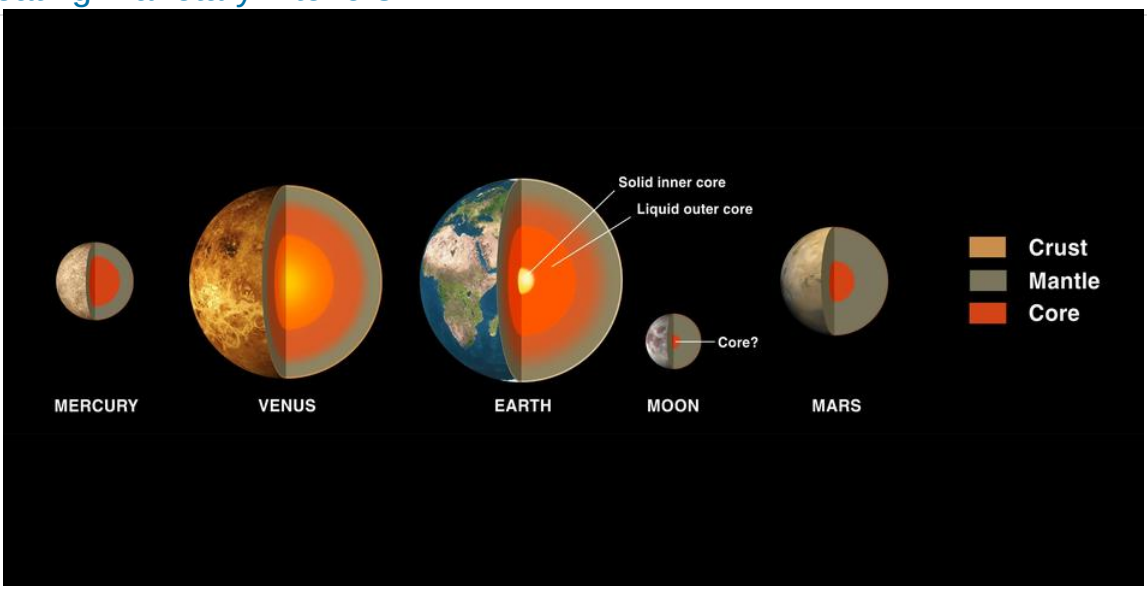
9.2: Heating Planetary Interiors



Of the four terrestrial planets plus the Moon, only the Earth is believed to have enough internal heat to keep the planet warm.

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As we noted in Section 91, accretion and differentiation occur when planets were young. Initially, planets have a lot of internal heat from their formation. Depending on the size of the planetary body, the heat from formation dissipates. Smaller bodies like the Moon or Mercury have lesser internal heat than the Earth. Convection transports heat as hot material rises and cool material falls. This transfer heat from the mantle to the crust. The heat then escapes into space through radiation. The rate at which a planetary interior cools off depends on its surface-to-volume ratio. Heat content depends on volume. Loss of heat through radiation depends on surface area. The time it takes for the planetary interior to cool depends on surface area divided by volume. Larger objects have a smaller ratio and cool more slowly. Smaller worlds cool off faster and harden earlier. As a result, the Moon and Mercury are now geologically "dead," having lost most of their internal heat from formation hundreds of millions of years ago.

While it has cooled of more slowly than the smaller terrestrial planets, the Earth also has another source of internal heat. Much of Earth's internal heat today comes from decay of radioactive isotopes. This has kept much of the Earth's interior molten and continues to drive the plate tectonics that shape and reshape the Earth's surface to this day.

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